



# STGB20NB41LZ

## N-CHANNEL CLAMPED 20A - D<sup>2</sup>PAK

### INTERNALLY CLAMPED PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGB20NB41LZ	CLAMPED	< 2.0 V	20 A

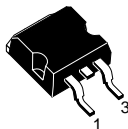
- POLYSILICON GATE VOLTAGE DRIVEN
- LOW THRESHOLD VOLTAGE
- LOW ON-VOLTAGE DROP
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- HIGH VOLTAGE CLAMPING FEATURE

#### DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The built in collector-gate zener exhibits a very precise active clamping while the gate-emitter zener supplies an ESD protection.

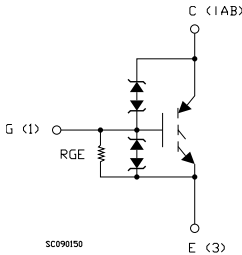
#### APPLICATIONS

- AUTOMOTIVE IGNITION



D<sup>2</sup>PAK

#### INTERNAL SCHEMATIC DIAGRAM



#### ORDER CODE

PART NUMBER	MARKING	PACKAGE	PACKAGING
STGB20NB41LZT4	GB20NB41LZ	D <sup>2</sup> PAK	TAPE & REEL

## STGB20NB41LZ

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-Emitter Voltage ( $V_{GS} = 0$ )	CLAMPED	V
$V_{ECR}$	Emitter-Collector Voltage	20	V
$V_{GE}$	Gate-Emitter Voltage	CLAMPED	V
$I_C$	Collector Current (continuous) at $T_C = 25^\circ\text{C}$	40	A
$I_C$	Collector Current (continuous) at $T_C = 100^\circ\text{C}$	20	A
$I_{CM}$ (■)	Collector Current (pulsed)	80	A
$E_{as}$	Single Pulse Energy $T_c = 25^\circ\text{C}$	700	mJ
$P_{TOT}$	Total Dissipation at $T_C = 25^\circ\text{C}$	200	W
	Derating Factor	1.33	W/°C
$E_{SD}$	ESD (Human Body Model)	8	KV
$T_{stg}$	Storage Temperature	- 55 to 175	°C
$T_j$	Operating Junction Temperature		

(■) Pulse width limited by safe operating area

### THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case Max	0.75	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient Max	62.5	°C/W

### ELECTRICAL CHARACTERISTICS ( $T_{CASE} = 25^\circ\text{C}$ UNLESS OTHERWISE SPECIFIED)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$BV_{(CES)}$	Clamped Voltage	$I_C = 2\text{ mA}$ , $V_{GE} = 0$ , $T_c = -40^\circ\text{C} \div 150^\circ\text{C}$	382	412	442	V
$BV_{(ECR)}$	Emitter Collector Break-down Voltage	$I_C = 75\text{ mA}$ , $T_c = 25^\circ\text{C}$	20	28		V
$BV_{GE}$	Gate Emitter Break-down Voltage	$I_G = \pm 2\text{ mA}$	12	14	16	V
$I_{CES}$	Collector cut-off Current ( $V_{GE} = 0$ )	$V_{CE} = 15\text{ V}$ , $V_{GE} = 0$ , $T_C = 150^\circ\text{C}$ $V_{CE} = 200\text{ V}$ , $V_{GE} = 0$ , $T_C = 150^\circ\text{C}$			10 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{CE} = 0$ )	$V_{GE} = \pm 10\text{ V}$ , $V_{CE} = 0$	$\pm 300$	$\pm 660$	$\pm 1000$	$\mu\text{A}$
$R_{GE}$	Gate Emitter Resistance		10	15	30	K $\Omega$

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}$ , $I_C = 250\mu\text{A}$ , $T_c = 25^\circ\text{C}$	1		2.4	V
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 4.5\text{ V}$ , $I_C = 10\text{ A}$ , $T_c = 25^\circ\text{C}$ $V_{GE} = 4.5\text{ V}$ , $I_C = 20\text{ A}$ , $T_c = 25^\circ\text{C}$		1.1 1.3	1.8 2.0	V V

## DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 25\text{ V}$ , $I_C = 20\text{ A}$		35		S
$C_{ies}$	Input Capacitance	$V_{CE} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GE} = 0$		2300		pF
$C_{oes}$	Output Capacitance			160		pF
$C_{res}$	Reverse Transfer Capacitance			25		pF
$Q_g$	Gate Charge	$V_{CE} = 320\text{ V}$ , $I_C = 20\text{ A}$ , $V_{GE} = 5\text{ V}$		46		nC

## FUNCTIONAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
II	Latching Current	$V_{Clamp} = 320\text{ V}$ , $T_C = 125\text{ }^\circ\text{C}$ $R_{Goff} = 1\text{ K}\Omega$ , $V_{GE} = 10\text{ V}$		40		A
U.I.S.	Functional Test Open Secondary Coil	$R_{Goff} = 1\text{ K}\Omega$ , $L = 1.6\text{ mH}$ , $T_C = 125\text{ }^\circ\text{C}$	20			A

## SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{CC} = 320\text{ V}$ , $I_C = 20\text{ A}$ $R_G = 1\text{ K}\Omega$ , $V_{GE} = 5\text{ V}$		1 0.22		$\mu\text{s}$ $\mu\text{s}$
$(di/dt)_{on}$	Turn-on Current Slope	$V_{CC} = 320\text{ V}$ , $I_C = 20\text{ A}$ $R_G = 1\text{ K}\Omega$ , $V_{GE} = 5\text{ V}$		140		A/ $\mu\text{s}$
$E_{on}$	Turn-on Switching Losses	$V_{CC} = 320\text{ V}$ , $I_C = 20\text{ A}$ , $T_C = 25\text{ }^\circ\text{C}$ $R_G = 1\text{ K}\Omega$ , $V_{GE} = 5\text{ V}$ , $T_C = 150\text{ }^\circ\text{C}$		5 5.1		mJ mJ

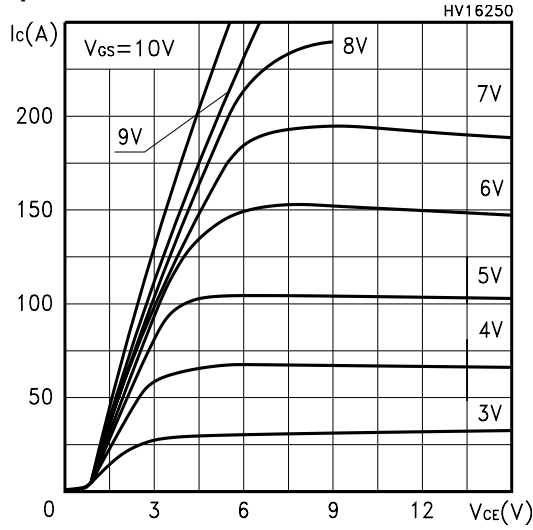
## SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{CC} = 320\text{ V}$ , $I_C = 20\text{ A}$ , $R_{GE} = 1\text{ K}\Omega$ , $V_{GE} = 5\text{ V}$		4.4		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time			2.5		$\mu\text{s}$
$t_{d(off)}$	Delay Time			12.1		$\mu\text{s}$
$t_f$	Fall Time			1.6		$\mu\text{s}$
$E_{off(**)}$	Turn-off Switching Loss			12.9		mJ
$t_c$	Cross-over Time	$V_{CC} = 320\text{ V}$ , $I_C = 20\text{ A}$ , $R_{GE} = 1\text{ K}\Omega$ , $V_{GE} = 5\text{ V}$ $T_j = 125\text{ }^\circ\text{C}$		6		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time			3.16		$\mu\text{s}$
$t_{d(off)}$	Delay Time			13.4		$\mu\text{s}$
$t_f$	Fall Time			2.7		$\mu\text{s}$
$E_{off(**)}$	Turn-off Switching Loss			18.4		mJ

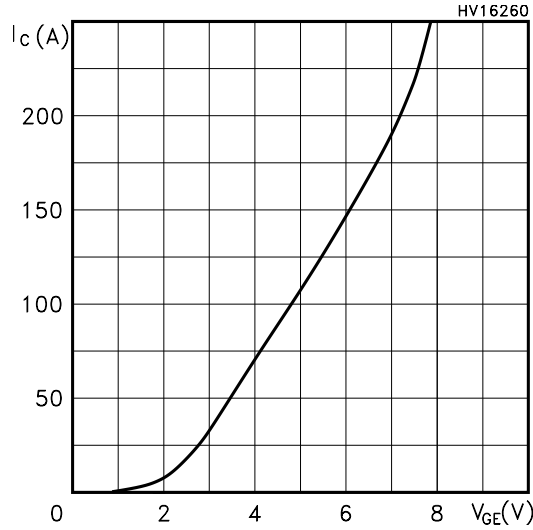
(1) Pulse width limited by max. junction temperature.

(\*\*) Losses Include Also the Tail

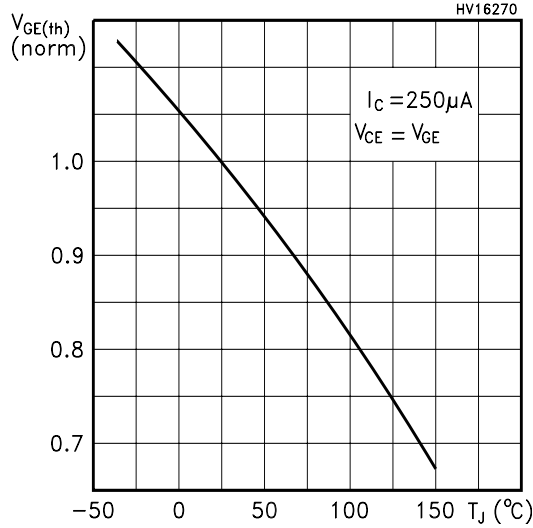
Output Characteristics



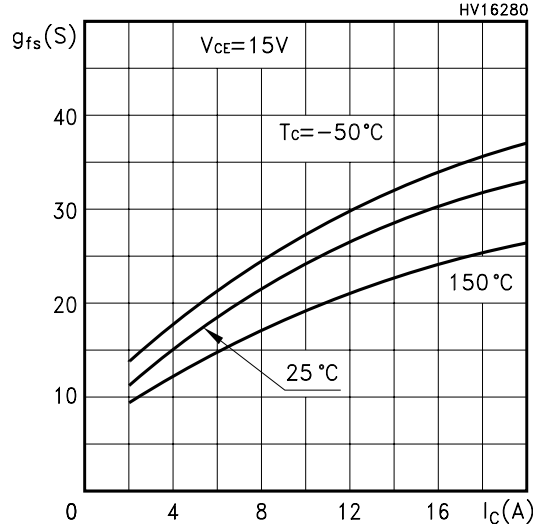
Transfer Characteristics



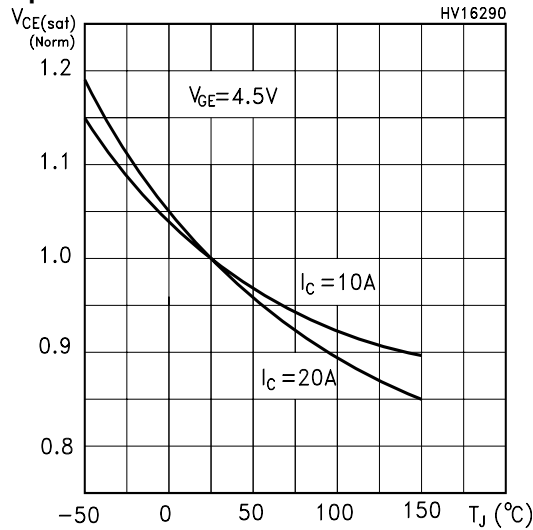
Normalized Gate Threshold Voltage vs Temp.



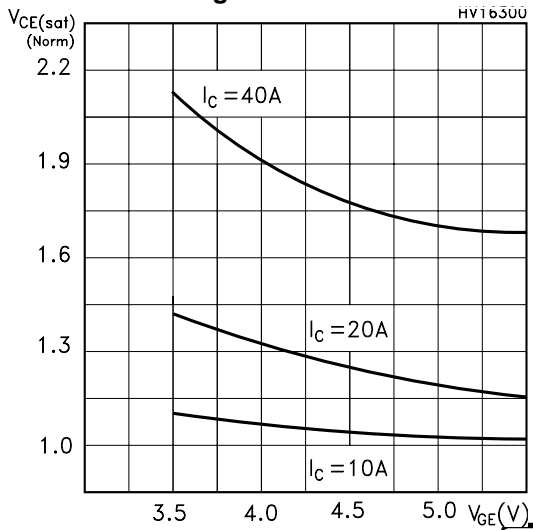
Transconductance



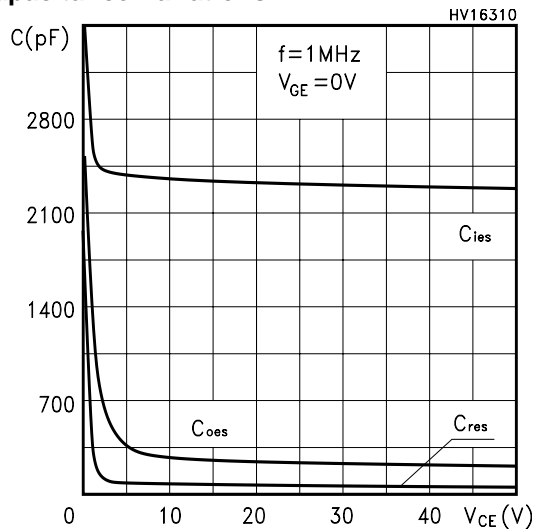
Normalized Collector-Emitter On Voltage vs Temperature



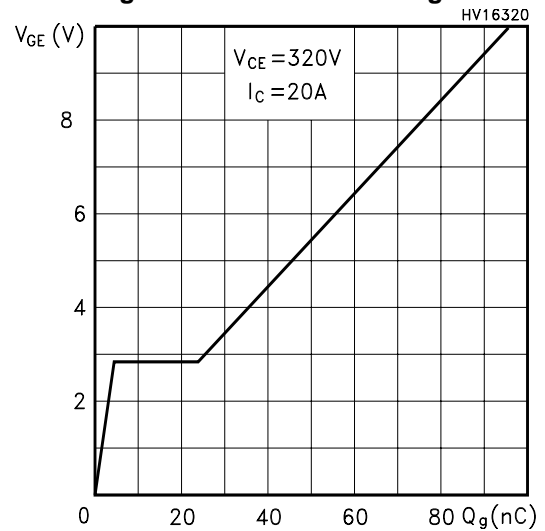
Normalized Collector-Emitter On Voltage vs Gate-Emitter Voltage



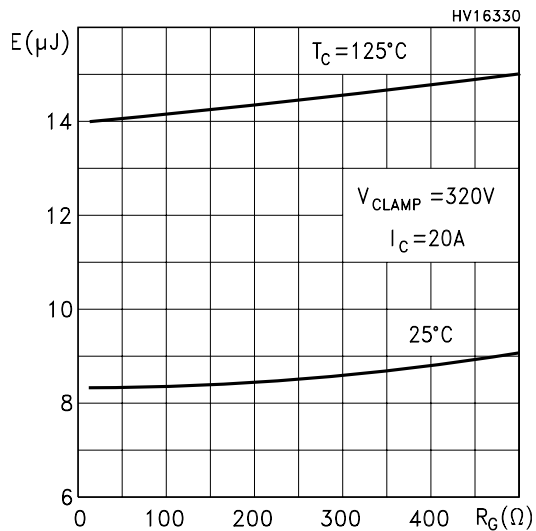
### Capacitance Variations



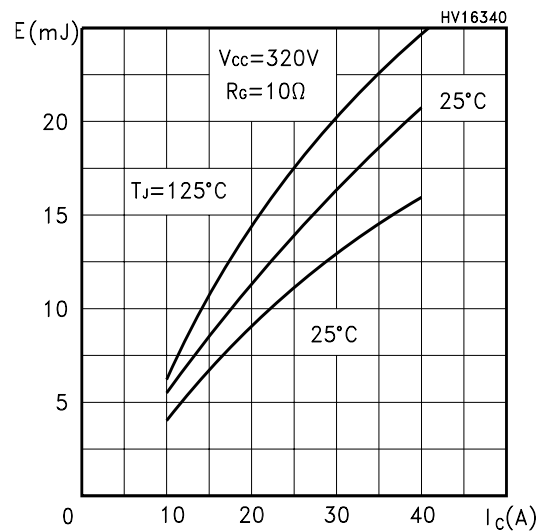
### Gate Charge vs Gate-Emitter Voltage



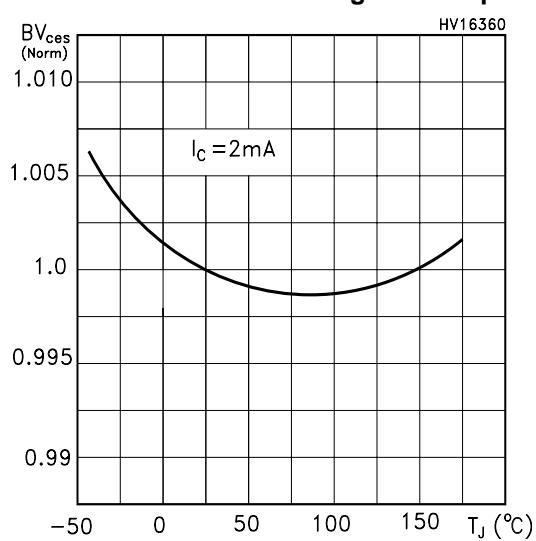
### Off Losses vs Gate Resistance



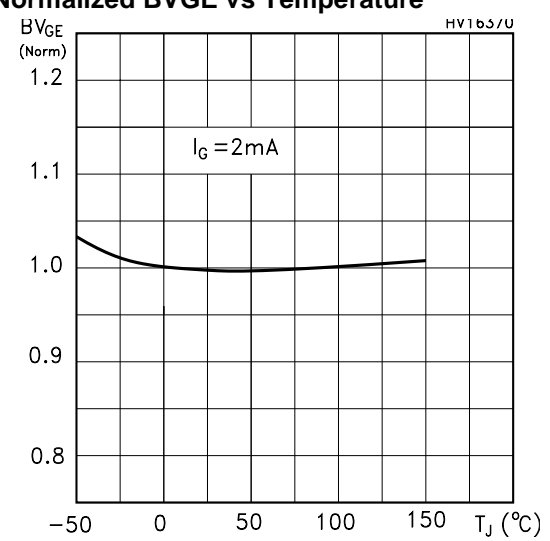
### Off Losses vs Collector Current



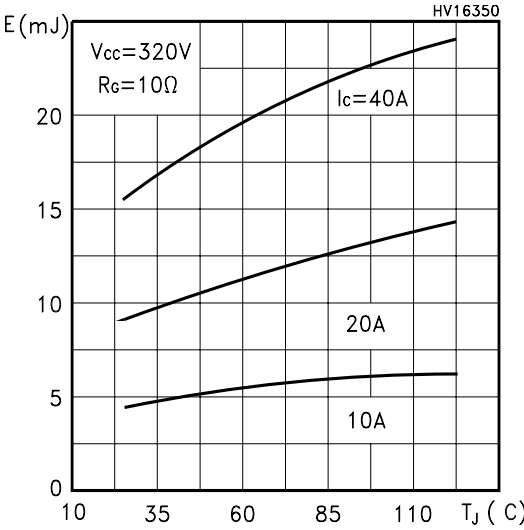
### Normalized Break-down Voltage vs Temp.



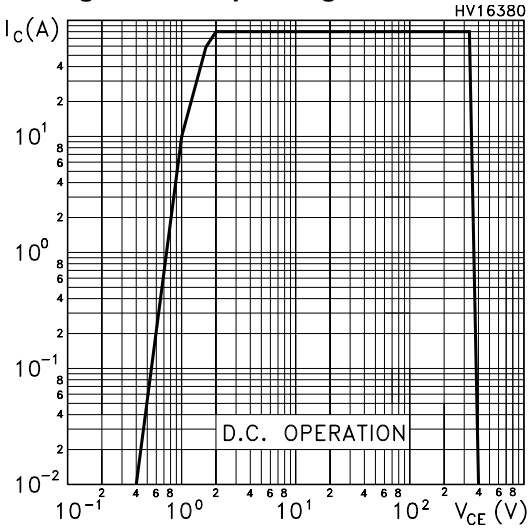
### Normalized BVGE vs Temperature



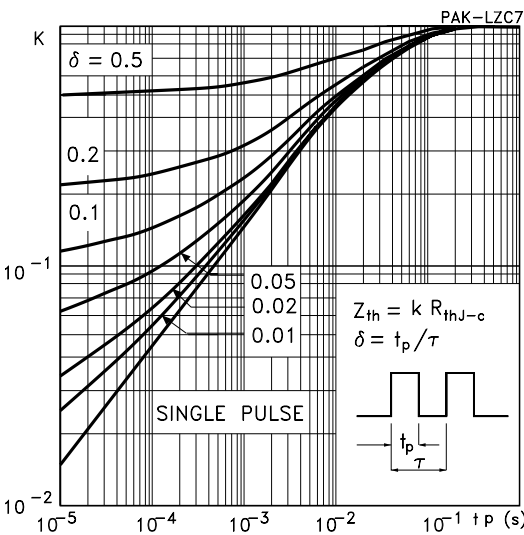
Off Losses vs Temperature



Switching Off Safe Operating Area

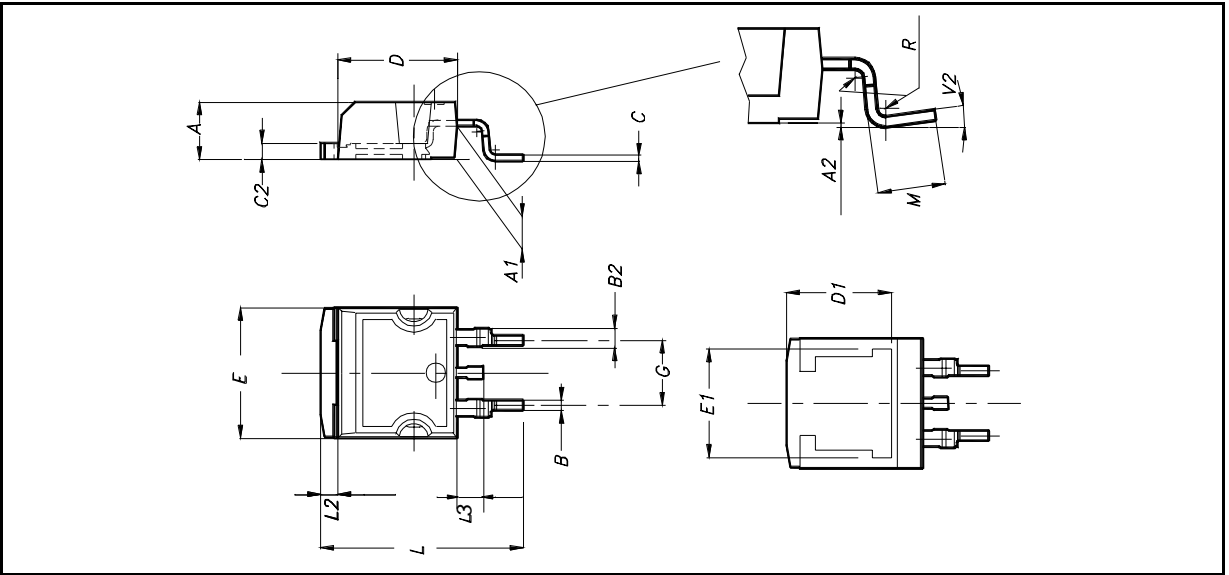


Thermal Impedance

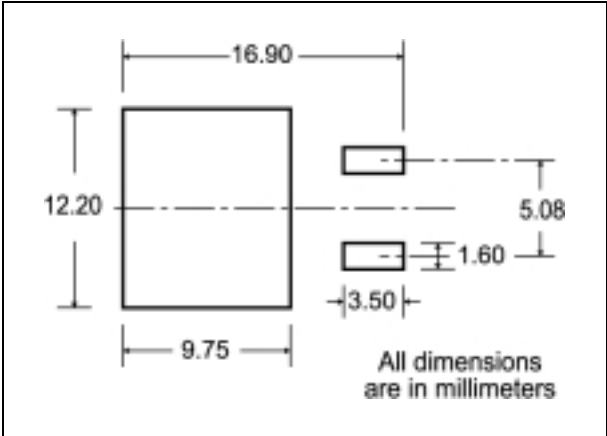


D<sup>2</sup>PAK MECHANICAL DATA

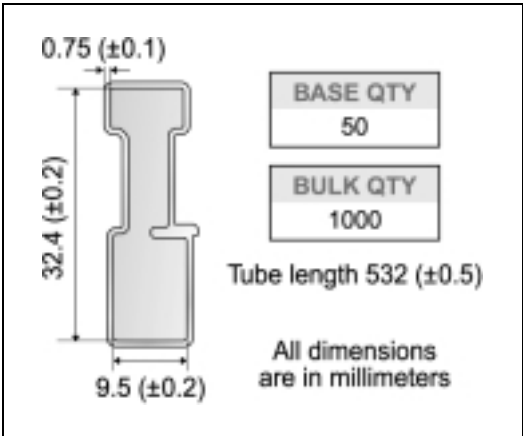
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		8°			



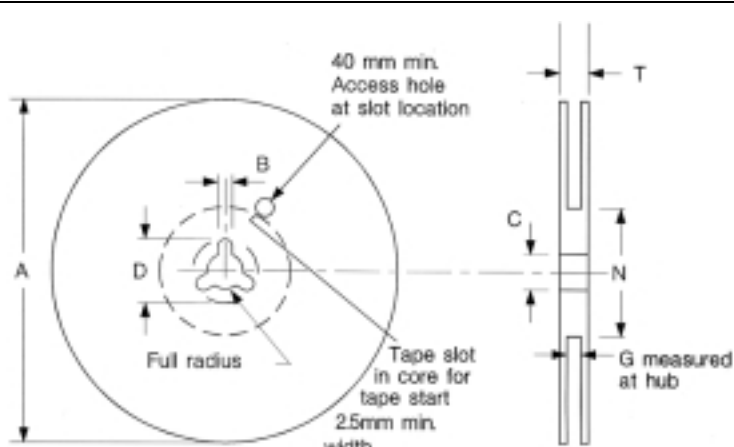
D<sup>2</sup>PAK FOOTPRINT



TUBE SHIPMENT (no suffix)\*



TAPE AND REEL SHIPMENT (suffix "T4")\*



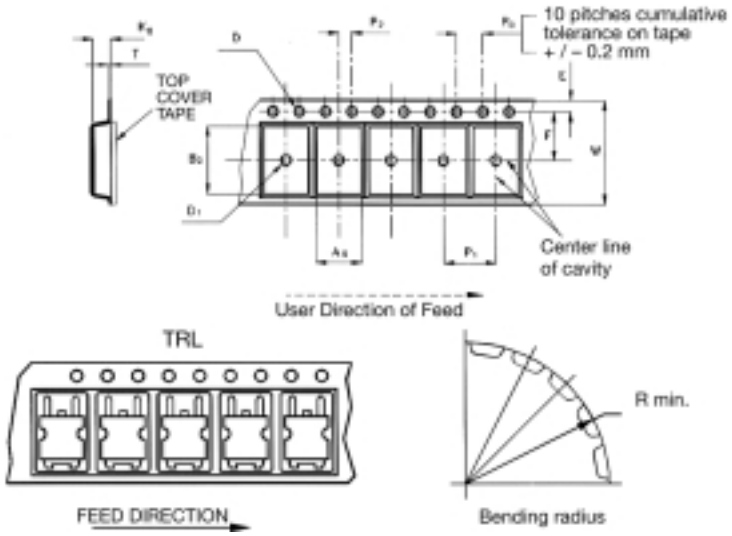
TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956

REEL MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000





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